REMARKS

Applicant is amending the claims as set forth above to better define the invention and to address the section 112 rejections. Applicant is also enclosing a copy of Figure 5 with a requested correction marked in red. Applicant is also enclosing a substitute declaration and an abstract on a separate sheet. If any additional fees are due, please charge them to Bracewell & Patterson, L.L.P. deposit account 50-259.

The examiner has rejected the claims on the basis of WO269 (Sullivan) and US 134 (Thiel). WO269 is concerned with an apparatus in which the discrete sheets are fed from a stack to a take-up mechanism. WO269 teaches drive rollers 14 driven by a servo motor that moves forward and stops in response to an arm 20. Drive rollers 14 freewheel once the lowermost sheet has been engaged by the take-up rollers 12. WO269 shows a vacuum suction device 15 that pulls the sheet against drive rollers 14. WO269 does not show a brake to restrain freewheeling motion once the lowermost sheet leaves drive rollers 14. WO269 also does not show a microprocessor that detects a rotational position of take-up rollers 12 and the position of the sheet as sensed by a sensor. The microprocessor controls the servo motor, unlike the servo motor of WO269, which is controlled by timing belt19 and arm 20.

US 134 is concerned with feed of continuous (endless) sheet material, not discrete sheets. A skilled person in the art would not contemplate combining the disclosures of these two references as they are essentially concerned with different types of equipment. In US 134, the endless sheet material is fed to a cutter that simply cuts off sections of sheet material which are then transferred to a processing station. US 134 does teach the feed of discrete sheets from a stack to a take-up mechanism which takes over feed of the sheets. In US 134, the knife roll simply cuts the sheet material but does not actually take over sheet feed from the upstream feed rollers 6.

Those skilled in the art therefore would not, at least not without the exercise of inventive insight, recognize that teaching in US 134 might have application to the discrete feed apparatus of WO269. Moreover, WO269 makes it clear at Page 3, final paragraph, that although the rollers 14 could be driven continuously by an electric motor, continuous rotation is not preferred since, in the case of a continuous drive, there will be some slippage between the rearward rollers and

the next sheet to be fed. In view of this, the skilled person would not be motivated to consider applying the teaching in US 134 to WO269 since US 134 is not only focused on feeding endless sheet material to a knife roller, which does not act as a take-up mechanism, but also involves the use of an electric motor which feeds the sheet material continuously, the very thing that WO269 teaches away from.

Even if, for the sake of argument, we consider the case where the teaching of US 134 is somehow incorporated into WO269, it would not be possible to achieve high line speeds for sheet feed and hence throughput. This is because, on the one hand, it is highly desirable to determine the extent of misregistration present shortly before the sheet reaches the take-up mechanism and, on the other hand, it takes a finite time to adjust the speed of sheet feed to compensate for misregistration. By delaying determination of the amount of misregistration present until the leading edge of the sheet is near to the take-up mechanism, any subsequent misregistration developing for that particular sheet is minimized. However, the closer the sheet is to the take-up mechanism before misregistration is determined, the shorter the time available to correct for it by means of the servo- motor, especially if a significant amount of misregistration has developed.

In a sheet feeder as disclosed in WO269, the rollers 14 (or conveyors) freewheel once the sheet has transferred to the take-up mechanism. The applicant has identified this as a limitation on the line speeds that can be achieved in practice because the freewheeling action of the rollers or conveyors causes inadvertent feed, and hence misregistration, of the next sheet to be fed once the previous sheet has cleared the rollers or conveyors.

When the line speed is increased to modern machine specifications, the freewheeling action starts to cause improper motion of the next-to-be-fed sheet. The inertia stored in the rollers combined with the suction effect of the outgoing sheet (which has a fairly large cross-sectional area when it is heavy duty corrugated board) "persuades" the next sheet to be fed to move forward out of register, so that it starts its journey ahead of the zero mark. If this were a consistent error, it could be readily compensated for. It is however and very importantly an inconsistent error, depending *inter alia* on the total weight of sheets stored in the hopper above the feed table, the weight of each sheet and the coefficient of friction of the sheet and roller surfaces.

For example, the distance from the gate of the feed table to the roll set is typically between 100 and 200mm. In practice, it is necessary to detect the sheet some time after the sheet feed stroke has begun so as to determine under **stable** conditions what the registration error is likely to be if the feed stroke continues unmodified. In practice, this sensing and detecting is left until the last possible moment, while still allowing sufficient time during the feed stroke for the microprocessor to determine the misregistration and command the servo motor to adjust the feed stroke by controlling the servo-motor to correct the registration in such a way the sheet material arrives at the roll set at exactly the precise moment in time and the precise point relative to the tooling on the take-up rollers. Even with the very latest electronic photo sensors systems, this imposes a limit on the line speed achievable, especially if a significant and inconsistent error is being introduced by the freewheeling action of the rollers.

The present invention, as now claimed in the amended version of claim 83 set out above, allows increased line speeds to be achieved while maintaining high precision in processing of the sheet. This is secured by the provision of a "restraining means for restraining feed of the next lowermost sheet by overrun of the freewheeling after the sheet being fed has cleared said drive-transmitting arrangement". Such restraining means can be implemented either by the vacuum suction chamber 30 as described with reference to Figure 1 and/or by the brake means 40 of Figure 4 (see Page 10, last paragraph). While WO 269 discloses a vacuum chamber, it does not disclose this in combination with a microprocessor and sensor as claimed.

The provision of the restraining means in the present invention ensures that no significant "freewheeling-induced" misregistration in the next sheet to be fed can develop as the preceding sheet clears the freewheeling rollers/conveyors. By substantially eliminating any misregistration developed from this source, the total amount of misregistration is reduced. For a given location of the sensor (32 in Figure 5), that in turn enables the line speed to be increased significantly while still affording the servo-motor adequate time in which to adjust out the misregistration.

Claim 75 depends from claim 70, which in turn depends from claim 83, requiring brake means acting on the rollers to stop the freewheeling motion. This feature is not suggested in WO 269.

New claims independent claims 104 and 107 require a sensor located between the gate and the take-up mechanism or rollers and a microprocessor that controls a servo-motor. Claim 104 requires that the drive mechanism cease freewheel rotation once the sheet has cleared the

drive mechanism. Claim 107 requires a brake that engages the drive roller set to stop freewheeling motion. .

In summary, for the sake of argument, even if the skilled person would, without exercising inventive insight, consider application of the teaching in US 134 to WO269, the result would fall short of the invention now claimed. Applicant respectfully requests favourable action.

Respectfully submitted,

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